



IBR Ride-Through

Overview and Fundamentals

Ryan D. Quint, PhD, PE

Founder and CEO

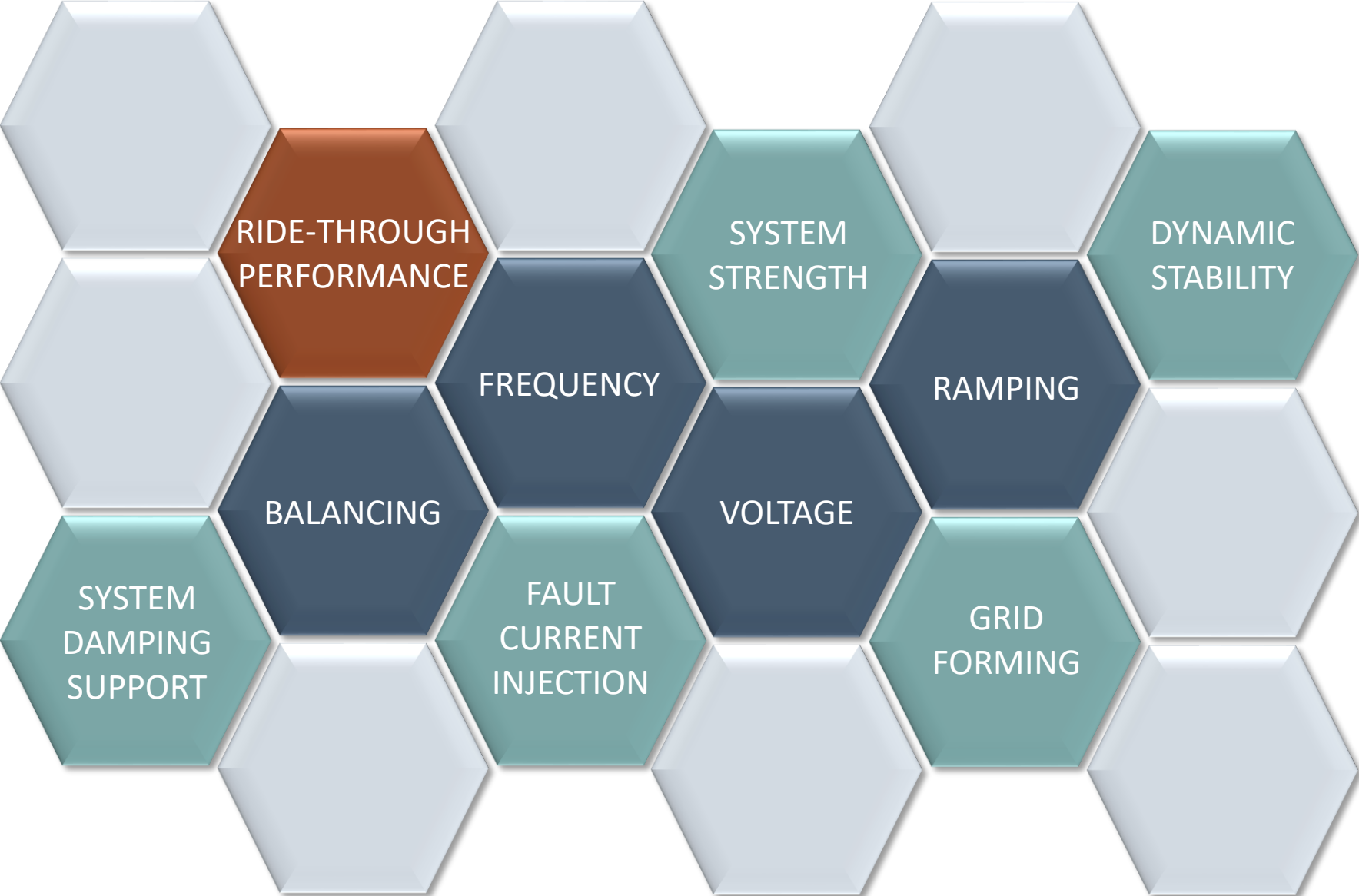
WECC "Reliability in the West" Webinar Series

February 2024

NERC Essential Reliability Services



NERC Essential Reliability Services



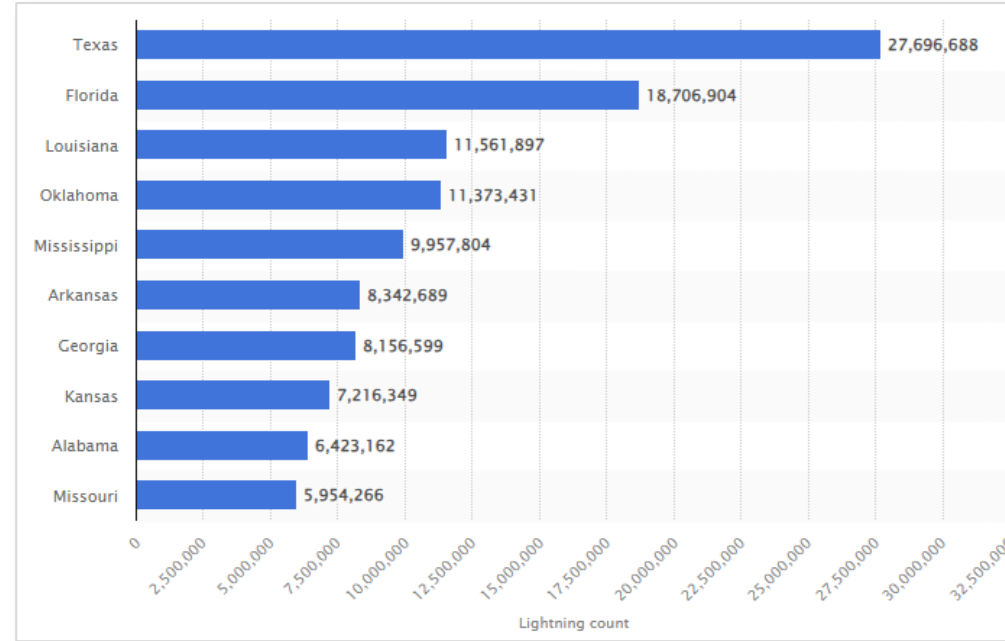
Generator Ride-Through

The ability of a generator (or power plant) to withstand short-term grid disturbances and continue to reliably operate

- **Critical** component of grid reliability and stability
 - Continuity of generation necessary for continuity of load
 - Minimize disruption to electricity supply to end-use customers
- Performance standards and requirements mandate certain levels of ride-through capability for generators

“Short-Term Grid Disturbances”

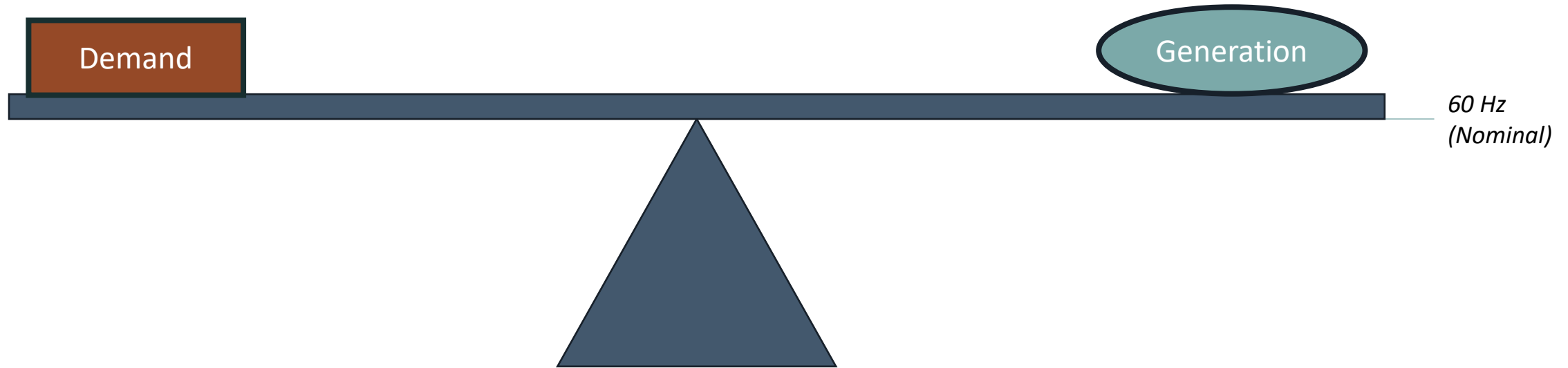
- Lightning strikes
- Equipment failures
- Animal interference
- Wildfires and smoke
- Natural disasters and storms
- Tree contact
- Cyber or physical attack
- Etc.



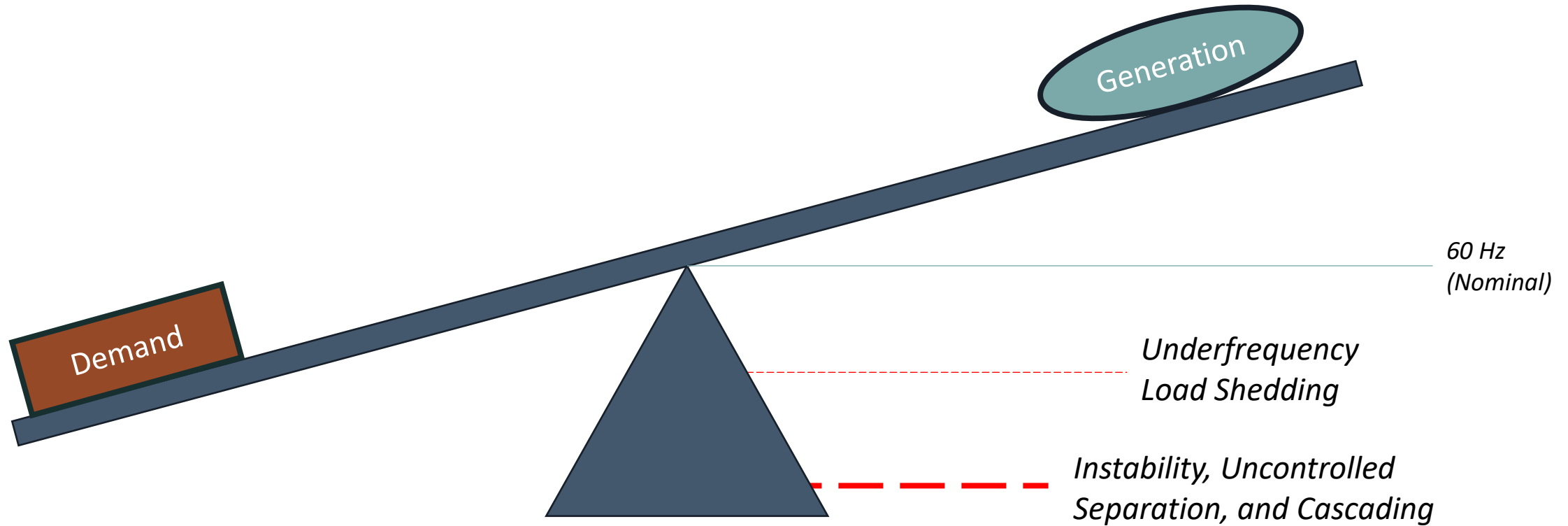
Source: [Statista](#)



Grid Frequency Stability



Grid Frequency Stability



NERC Disturbance Reports

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1,200 MW Fault Induced Solar Photovoltaic Resource Interruption Disturbance Report

Southern California 8/16/2016 Event
June 2017

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900 MW Fault Induced Solar Photovoltaic Resource Interruption Disturbance Report

Southern California Event: October 9, 2017
Joint NERC and WECC Staff Report
February 2018

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April and May 2018 Fault Induced Solar Photovoltaic Resource Interruption Disturbances Report

Southern California Events: April 20, 2018 and May 11, 2018
Joint NERC and WECC Staff Report
January 2019

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San Fernando Disturbance

Southern California Event: July 7, 2020
Joint NERC and WECC Staff Report
November 2020

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Odessa Disturbance

Texas Events: May 9, 2021 and June 26, 2021
Joint NERC and Texas RE Staff Report
September 2021

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Multiple Solar PV Disturbances in CAISO

Disturbances between June and August 2021
Joint NERC and WECC Staff Report
April 2022

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Panhandle Wind Disturbance

Texas Event: March 22, 2022
Joint NERC and Texas RE Staff Report
August 2022

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2022 Odessa Disturbance

Texas Event: June 4, 2022
Joint NERC and Texas RE Staff Report
December 2022

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2023 Southwest Utah Disturbance

Southwestern Utah: April 10, 2023
Joint NERC and WECC Staff Report
August 2023

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2022 California Battery Energy Storage System Disturbances

California Events: March 9 and April 6, 2022
Joint NERC and WECC Staff Report
September 2023

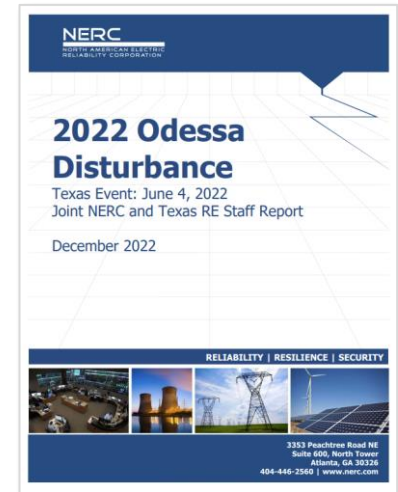
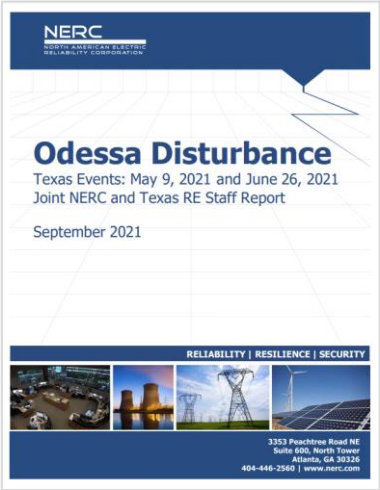
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Need for Immediate Action

- **Ride-Through Standard In Lieu Of PRC-024-3:** The PRC-024 standard is not effectively or efficiently addressing a systemic reliability gap of inverter-based resources tripping for POI voltages within the “no trip zone” curves. Updates were recently made to PRC-024-3 to add clarity to the expectations; however, newly interconnecting resources are being installed with hidden protections within the inverter that will trip for local inverter terminal conditions regardless of POI voltage conditions. This has been shown to be a systemic issue in nearly all past disturbances analyzed and is not expected to be addressed in existing facilities since these limits are hard-coded into the inverters.⁵ Furthermore, PLL loss of synchronism, dc reverse current, wind turbine failures,⁶ and many other issues exist that are not directly related to voltage and frequency protection. Lastly, facilities most commonly have their voltage and frequency protection set “for compliance with PRC-024” rather than based on equipment ratings within the facility. Multiple GOs/GOPs have been unable to identify what is actually being protected and have stated that they are set based on compliance. This is a misinterpretation of the standard and has led to degraded performance due to unnecessary tripping events. Based on the growing evidence and ongoing work to investigate poorly performing resources during fault events, NERC recommends that a comprehensive generator ride-through standard be implemented either as a NERC Reliability Standard or as part of the FERC Generator Interconnection Agreement.

- **There is an immediate need for a performance-based, comprehensive generator ride-through standard.** NERC staff submitted a SAR to the NERC Standards Committee that proposed the complete overhaul of PRC-024-3 and replacing it with a performance-based comprehensive ride-through standard that ensures generators remain connected to the BPS during system disturbances. That SAR was endorsed by the NERC Standards Committee in April 2022. Project 2020-02 was recast to begin developments of the replacement for PRC-024-3. The 2022 Odessa Disturbance reiterates the criticality and strong need for this standard enhancement, and NERC wholly supports the expeditious development and approval of this enhanced standard by industry. The standard needs sufficient clarity and specificity to ensure all associated failure modes during ride-through events are accounted for in the standard.



Trace the Problem



Same Team Mentality

- Decarbonization depends on reliable operation of a clean and predominantly inverter-based generation fleet
- Equipment standards and performance requirements must ensure reliable operational performance
- Addressing ride-through performance is **Step 0** in tackling the more difficult reliability challenges ahead during the energy transition
 - Energy adequacy
 - Grid stability
 - System strength
 - Oscillations
 - Controller interactions
 - Inertia and FFR
 - IBR fault current and relaying
 - Etc.



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